

### “MENTAL TREADMILL” – “FOCUS FIVE” – “BELLRINGERS”

These exercises are designed to challenge math students to think both *logically* and *creatively*. Getting the “correct” answer is not as important as the thought process that the question induces. Share ideas with classmates and have fun!

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#### Add 1–100 (Take a “Gauss”)

Without using a calculator (or your cell phone ☺), find an efficient way to add together the first 100 natural numbers  $\{1+2+3+\dots+98+99+100=?\}$ .

If you think you have the correct sum, try to create a formula that would calculate the sum up to any number.

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**Teacher Age** (calculators okay, internet/apps no!)

Today’s date is \_\_\_\_\_.

Your teacher may have been born on **July 17th, 1988**.

How many **years** old is your teacher?

How many **months** has he been alive?

How many **days** has he been alive?

(Remember that a *leap* year has 29 days in February: 1988, 1992, 1996, 2000, 2004, 2008, 2012)

Extra-Credit:

What day of the week was he born?

Is there a general formula/algorithm that you could use to determine the weekday of someone’s birth?

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#### I Sudoku – Can You?

Your challenge is to fill in this 3x3 square with the digits #1–9  $\{1,2,\dots,8,9\}$  so that *each* row, column, and diagonal sum to the same number. [No repeat digits!]

For example:

- I have arranged some of the digits #1-9 so that the red column, the green row, and the blue diagonal all sum to the same number: 11.
- Since my sum is 11, I should try to arrange the remaining digits  $\{5,7,9\}$  so that *every* direction sums to 11.
- If that is impossible, I should try a different arrangement or sum.


6		
3	4	
2	8	1

=11

=11

=11

## Looking for Patterns

Determine the pattern used to create these number sequences

Then write down the *next two* numbers in each sequence:

- A: 1, 4, 7, 10, 13, 16, ....  
B: 2, 4, 8, 16, 32, ...  
C: 1, 4, 9, 16, 25, ...  
D: 1, 8, 27, 64, 125, ...  
E: 1, 3, 6, 10, 15, 21, ...  
F: 2, 3, 5, 7, 11, 13, ...  
G: 0, 1, 2, 5, 26, ...  
H: 0, 1, 1, 2, 3, 5, 8, ...  
I: 10, 11, 13, 17, 25, 32, 37, 47, 58...
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## Graph It!

Draw and label a graph representing each of these situations, then answer the question.

Situation 1: Attendance at a party. A group of 4 people arrive every 10 minutes.

How many people are at the party after an hour and a half?

Situation 2: Walking home from school. You can walk about one mile in fifteen minutes.

If your home is 2.8 miles away, how much time do you need to walk home from school?

Situation 3: Throwing a ball. You throw a baseball into the air. It reaches a height of 25 meters and lands 45 meters away. Take a guess as to what angle the ball was thrown and how much time it was in the air.

Situation 4: Zombie tag. At the start of the game, there is 1 person assigned to be a zombie. A zombie chases the other players and when someone is tagged by a zombie, that person becomes a zombie.

Each zombie is able to tag 2 people each minute.

If 80 people are playing, how long will it take for all players to be turned into zombies?

Situation 5: Hungry brother. Your brother loves chips, but he feels guilty eating an entire bag by himself.

Each day, he decides to only eat half of the chips that are left in the bag.

How many days will it take for him to eat all the chips?

Situation 6: Temperature. The average temperature in Logan varies cyclically with the seasons.

In the winter, the lows are ~10s degrees F. In the summer, the highs are ~90s degrees F.

What would average temperatures be in the spring and fall?

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## Medal Count

In the 2004 Summer Olympics in Athens, Greece, the United States earned 6 more gold medals than bronze. The number of silver medals earned was 19 less than twice the number of bronze medals. The U.S. earned a total of 103 medals.

How many of each kind of medal did the U.S. earn?

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## Gaming Probability

Suppose your teacher is the owner of a casino. Look over these games and decide which one you would like to play to try to win some money. Have fun!



- Game 1: It only costs \$2.00 to roll two fair dice.  
If you roll “doubles” (ex. 5 and 5, 1 and 1), you win \$10.00!
- Game 2: It only costs \$5.00 to roll two fair dice.  
If the dice sum to seven (ex. 3 + 4, 6 + 1), you win \$25.00!  
If the dice sum to twelve (6 + 6), you win \$200.00!
- Game 3: It only costs \$1.00 to pick two cards from a 52-card deck.  
If they are the same color, you can play again for free!  
If they are the same suit (ex. both hearts), you win \$3.00!  
If you draw two face cards (K,Q,J), you win \$4.00!  
If they are the same value (ex. 8 and 8), you win \$15.00!
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## List of Primes

Calculate (without Internet/calculator) with the goal to write a list of all prime numbers from 1–100.

Remember:

A prime is a number only divisible by itself and 1. (ex. 2, 3, 19)

A composite is a number with more factors than itself and 1. (ex. 4, 6, 80)

By definition, 1 is not prime. 2 is the only even prime.

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## Prime Formula?

Most people know the first ten primes numbers or so. Here is a list of the prime numbers from 1-2000.

I have made a fantastic discovery – a formula for prime numbers  $\geq 41$  – that will make me famous!

$$P(n) = n^2 - n + 41$$

If you substitute any positive number  $n$

(1, 2, 3, ... ) into this function the result will be prime – cool!

You better check my work, just to be sure... (really the work of Euler in 1772)

Input interpretation:

primes less than or equal to 2000

Values:

2 | 3 | 5 | 7 | 11 | 13 | 17 | 19 | 23 | 29 | 31 | 37 |  
41 | 43 | 47 | 53 | 59 | 61 | 67 | 71 | 73 | 79 | 83 |  
89 | 97 | 101 | 103 | 107 | 109 | 113 | 127 | 131 | 137 |  
139 | 149 | 151 | 157 | 163 | 167 | 173 | 179 | 181 |  
191 | 193 | 197 | 199 | 211 | 223 | 227 | 229 | 233 |  
239 | 241 | 251 | 257 | 263 | 269 | 271 | 277 | 281 |  
283 | 293 | 307 | 311 | 313 | 317 | 331 | 337 | 347 |  
349 | 353 | 359 | 367 | 373 | 379 | 383 | 389 | 397 |  
401 | 409 | 419 | 421 | 431 | 433 | 439 | 443 | 449 |  
457 | 461 | 463 | 467 | 479 | 487 | 491 | 499 | 503 |  
509 | 521 | 523 | 541 | 547 | 557 | 563 | 569 | 571 |  
577 | 587 | 593 | 599 | 601 | 607 | 613 | 617 | 619 |  
631 | 641 | 643 | 647 | 653 | 659 | 661 | 673 | 677 |  
683 | 691 | 701 | 709 | 719 | 727 | 733 | 739 | 743 |  
751 | 757 | 761 | 769 | 773 | 787 | 797 | 809 | 811 |  
821 | 823 | 827 | 829 | 839 | 853 | 857 | 859 | 863 |  
877 | 881 | 883 | 887 | 907 | 911 | 919 | 929 | 937 |  
941 | 947 | 953 | 967 | 971 | 977 | 983 | 991 | 997 |  
1009 | 1013 | 1019 | 1021 | 1031 | 1033 | 1039 | 1049 |  
1051 | 1061 | 1063 | 1069 | 1087 | 1091 | 1093 | 1097 |  
1103 | 1109 | 1117 | 1123 | 1129 | 1151 | 1153 | 1163 |  
1171 | 1181 | 1187 | 1193 | 1201 | 1213 | 1217 | 1223 |  
1229 | 1231 | 1237 | 1249 | 1259 | 1277 | 1279 | 1283 |  
1289 | 1291 | 1297 | 1301 | 1303 | 1307 | 1319 | 1321 |  
1327 | 1361 | 1367 | 1373 | 1381 | 1399 | 1409 | 1423 |  
1427 | 1429 | 1433 | 1439 | 1447 | 1451 | 1453 | 1459 |  
1471 | 1481 | 1483 | 1487 | 1489 | 1493 | 1499 | 1511 |  
1523 | 1531 | 1543 | 1549 | 1553 | 1559 | 1567 | 1571 |  
1579 | 1583 | 1597 | 1601 | 1607 | 1609 | 1613 | 1619 |  
1621 | 1627 | 1637 | 1657 | 1663 | 1667 | 1669 | 1693 |  
1697 | 1699 | 1709 | 1721 | 1723 | 1733 | 1741 | 1747 |  
1753 | 1759 | 1777 | 1783 | 1787 | 1789 | 1801 | 1811 |  
1823 | 1831 | 1847 | 1861 | 1867 | 1871 | 1873 | 1877 |  
1879 | 1889 | 1901 | 1907 | 1913 | 1931 | 1933 | 1949 |  
1951 | 1973 | 1979 | 1987 | 1993 | 1997 | 1999 (303 primes)

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